

Regulatory History / Technical Data (Non-EPA & LDEQ)

1.	40 CFR Part 70 General Conditions- (Title V)
2.	Dupont on Sulfuric acid regeneration
3.	Toxic Release Inventory - Dupont
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5.	LSP / DEQ Incident Reports (2010/2012)
6.	Sulfur Trioxide (SO_3) Datasheet
7.	Sulfur Trioxide - Dupont description
8.	Sulfuric Acid chemistry
9.	Sulfur Trioxide Impact
10.	"Sulfuric Acid Today" Article on Dupont
11.	News article on sulfur trioxide air release (BASF)
12.	Email from D-Ford (CR6) re: RQ's - 5/23/12
13.	"Sulfuric Acid Mist: Regulating Uncertainties"
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15.	Dupont Burnside Diagram
16.	"Strong Inorganic Acid Mists Containing Sulfuric Acid"
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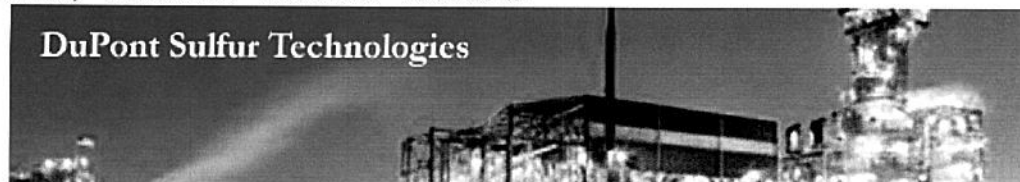
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Sulfuric Acid Regeneration (SAR)



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DuPont provides SAR services for spent sulfuric acid, effectively regenerating it to commercial quality.

DuPont's involvement in the industry dates back to the first commercial production of sulfuric acid. Sulfuric acid regeneration is a core business for DuPont, evidenced by their investment globally in the business as well as the high growth rates experienced in many regions of the world.

In addition, DuPont brings approximately 75 years of experience in alkylation technology development and licensing with our STRATCO® group, the leading technology provider in sulfuric acid alkylation technology worldwide. The recent addition of BELCO®, a company known by the refining industry to provide superior air emission control technologies, applies yet another technology to the suite of solutions that are optimized for each refinery to help them achieve their objectives with a solution that is lower, or neutral, in cost to the refinery's next best alternative.

Although DuPont has access to a vast array of internal technologies, the evaluation process leading to the best possible alternative solutions for the refinery extends to all commercially proven technologies which can be licensed and integrated with our offering – providing maximum benefits to refinery and community stake holders.

Identifying an acceptable solution requires close collaboration with refinery technical and environmental personnel. But, if a refiner chooses to work with DuPont, the onus to evaluate the technical capabilities and economics of each alternative solution is no longer a load on the refinery's technical staff. This allows them to focus on existing hydrocarbon improvement projects. In addition, all permitting and construction activities are managed by DuPont.

Alkylation-Spent Sulfuric Acid Regeneration

DuPont's largest spent sulfuric acid regeneration facility is located in Burnside, Louisiana. This spent sulfuric acid regeneration plant has been continuously upgraded since its construction in 1968. Strategically located in the heart of the Gulf Coast region on the Mississippi River, the facility can receive and ship acid via barge, rail car or tank truck. This provides our clients with the maximum logistical flexibility when servicing their spent acid regeneration needs. This plant has won numerous awards within DuPont, as well as within the community and state, for its safety and environmental record and has set records for operational up-time.

Our goal is to make the spent-sulfuric-acid to fresh-sulfuric-acid transaction "worry-free" for our customers.

Chemical-Spent Sulfuric Acid Regeneration

The Burnside Plant has the capability to regenerate chemical-spent sulfuric acids. DuPont can provide our customers with technical experts and logistical support to optimize their acid usage and minimize their logistical expenses thereby minimizing their overall acid cost.

On-Site Sulfuric Acid Regeneration Facilities

For refineries operating a sulfuric acid alkylation unit and requiring additional sulfur recovery capacity, DuPont offers unique on-site sulfuric acid regeneration and sulfur gas recovery offerings that provide cost effective, environmentally superior, and flexible alternatives to the classic refinery sulfur management system. DuPont will build, own, operate and maintain an on-site sulfuric acid plant that not only regenerates the refiner's spent acid, but also recovers part or all of a refiner's acid gas as sulfuric acid or other sulfur products. Such an offering compliments the refiner's alkylation unit while either increasing or replacing a refiner's existing sulfur recovery capacity and thereby avoid capital investment to construct one or more classic Claus-Tail Gas Units. These plants have environmental emissions that are superior to classic Claus-Tail Gas Units as well as better up-time capabilities.

DuPont owns, operates, and maintains an integrated on-site acid regeneration unit at the Delaware City Refinery which started up in September 2005. The Delaware City or Red Lion on-site SAR facility, not only provides the adjacent refinery with sulfur acid regeneration services, but also provides sulfur management services by recovering part of the refinery's acid gas production as sulfuric acid.

DuPont has partnered with a refinery in El Paso, TX to build an on-site spent acid regeneration facility. This integrated on-site sulfuric acid regeneration-sulfur gas recovery (SAR/SGR) facility will be operational in the 4th quarter of 2007. Our Borderland Plant in El

Paso, TX, will not only provide acid regeneration services, but will process all of the high strength sulfur bearing gases from the refinery, replacing the existing Claus-Tail Gas Units. This twin train facility will improve the flexibility, reliability and operations of the refinery while providing a significant reduction in sulfur dioxide emissions compared to their existing alternative.

DuPont has also partnered with a refinery in Bayway, NJ to build, own, operate and maintain an integrated on-site sulfuric acid regeneration-sulfur gas recovery (SAR/SGR) facility. This integrated on-site sulfuric acid regeneration-sulfur gas recovery (SAR/SGR) facility will be operational in the 4th quarter of 2007. The Bayway, NJ or Moses Mill plant not only will provide acid regeneration services for the refinery, but will also provide total sulfur management for the entire facility by processing all of the sulfur bearing gases from the refinery. The twin train SAR/SGR plant will provide a reliable, cost effective, environmentally superior alternative to the refinery's alternative sulfur recovery options.


Literature

- Meeting environmental challenges through alternative sulfur management solutions

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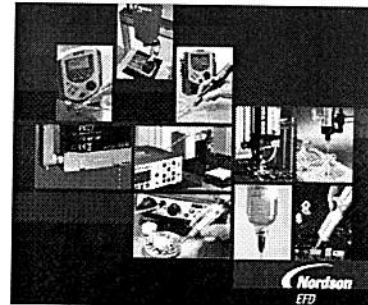
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DuPont Plant Delayed Reporting Leak

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CHARLESTON, W.Va. (AP) -- Government and company officials say managers at DuPont's Belle chemical plant waited two days to report a toxic material leak to authorities.

No one was injured when the sulfur trioxide leaked on July 22.

The leak occurred in a sulfuric acid production unit that was the subject of a major federal enforcement action. The company agreed in April to pay \$2 million in fines for not upgrading pollution-control technology when it added equipment.

DuPont officials initially estimated the leak at 300 to 400 pounds, and federal law requires notification of leaks of 100 pounds or more. DuPont later downgraded its estimate to about 18 pounds.

Sulfur trioxide can burn the skin and eyes and damage the respiratory tract if inhaled.

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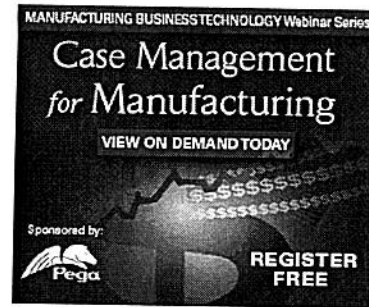
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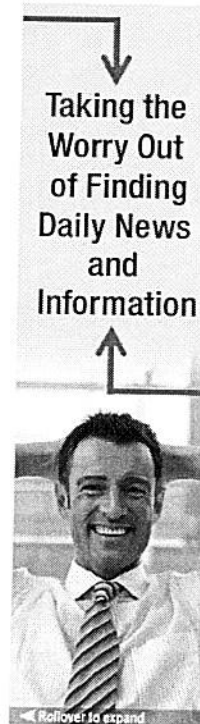
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Environmental management of sulfur trioxide emission: impact of SO₃ on human health.

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Abstract

The major contributors to global acidification are sulfur oxides and nitrogen oxides emitted mostly by the burning of fossil fuels. From the scientific point of view, it is necessary to make a clear distinction between sulfur dioxide and sulfur trioxide when referring to sulfur oxides. These two air pollutants have different properties. This paper reports the following aspects: the strong effect of sulfur trioxide on local human health (a case study of asthma in Yokkaichi), the problem of corrosion caused by sulfur trioxide, the difference in analytical methods for determining sulfur dioxide concentrations and sulfur trioxide concentrations, and the difference in removal methods for sulfur dioxide and sulfur trioxide. An important initiative at the third European conference of environment ministers was that the issue of human health related to local air pollution should be given priority over that of global pollution. The declines in the emissions of sulfur dioxide and nitrogen oxides have mainly been effective in reducing acidification due to long-range transport. The reduction in sulfur trioxide may be more effective in improving local human health mentioned in the initiative.

PMID: 11393318 [PubMed - indexed for MEDLINE]

MeSH Terms, Substances

LinkOut - more resources

8.10 Sulfuric Acid

8.10.1 General¹⁻²

Sulfuric acid (H_2SO_4) is a basic raw material used in a wide range of industrial processes and manufacturing operations. Almost 70 percent of sulfuric acid manufactured is used in the production of phosphate fertilizers. Other uses include copper leaching, inorganic pigment production, petroleum refining, paper production, and industrial organic chemical production.

Sulfuric acid may be manufactured commercially by either the lead chamber process or the contact process. Because of economics, all of the sulfuric acid produced in the U. S. is now produced by the contact process. U. S. facilities produce approximately 42 million megagrams (Mg) (46.2 million tons) of H_2SO_4 annually. Growth in demand was about 1 percent per year from 1981 to 1991 and is projected to continue to increase at about 0.5 percent per year.

8.10.2 Process Description³⁻⁵

Since the contact process is the only process currently used, it will be the only one discussed in this section. Contact plants are classified according to the raw materials charged to them: elemental sulfur burning, spent sulfuric acid and hydrogen sulfide burning, and metal sulfide ores and smelter gas burning. The contributions from these plants to the total acid production are 81, 8, and 11 percent, respectively.

The contact process incorporates 3 basic operations, each of which corresponds to a distinct chemical reaction. First, the sulfur in the feedstock is oxidized (burned) to sulfur dioxide (SO_2):



The resulting sulfur dioxide is fed to a process unit called a converter, where it is catalytically oxidized to sulfur trioxide (SO_3):



Finally, the sulfur trioxide is absorbed in a strong 98 percent sulfuric acid solution:



8.10.2.1 Elemental Sulfur Burning Plants -

Figure 8.10-1 is a schematic diagram of a dual absorption contact process sulfuric acid plant that burns elemental sulfur. In the Frasch process, elemental sulfur is melted, filtered to remove ash, and sprayed under pressure into a combustion chamber. The sulfur is burned in clean air that has been dried by scrubbing with 93 to 99 percent sulfuric acid. The gases from the combustion chamber cool by passing through a waste heat boiler and then enter the catalyst (vanadium pentoxide) converter. Usually, 95 to 98 percent of the sulfur dioxide from the combustion chamber is converted to sulfur trioxide, with an accompanying large evolution of heat. After being cooled, again by generating steam, the converter exit gas enters an absorption tower. The absorption tower is a packed column where acid is sprayed in the top and where the sulfur trioxide enters from the bottom. The

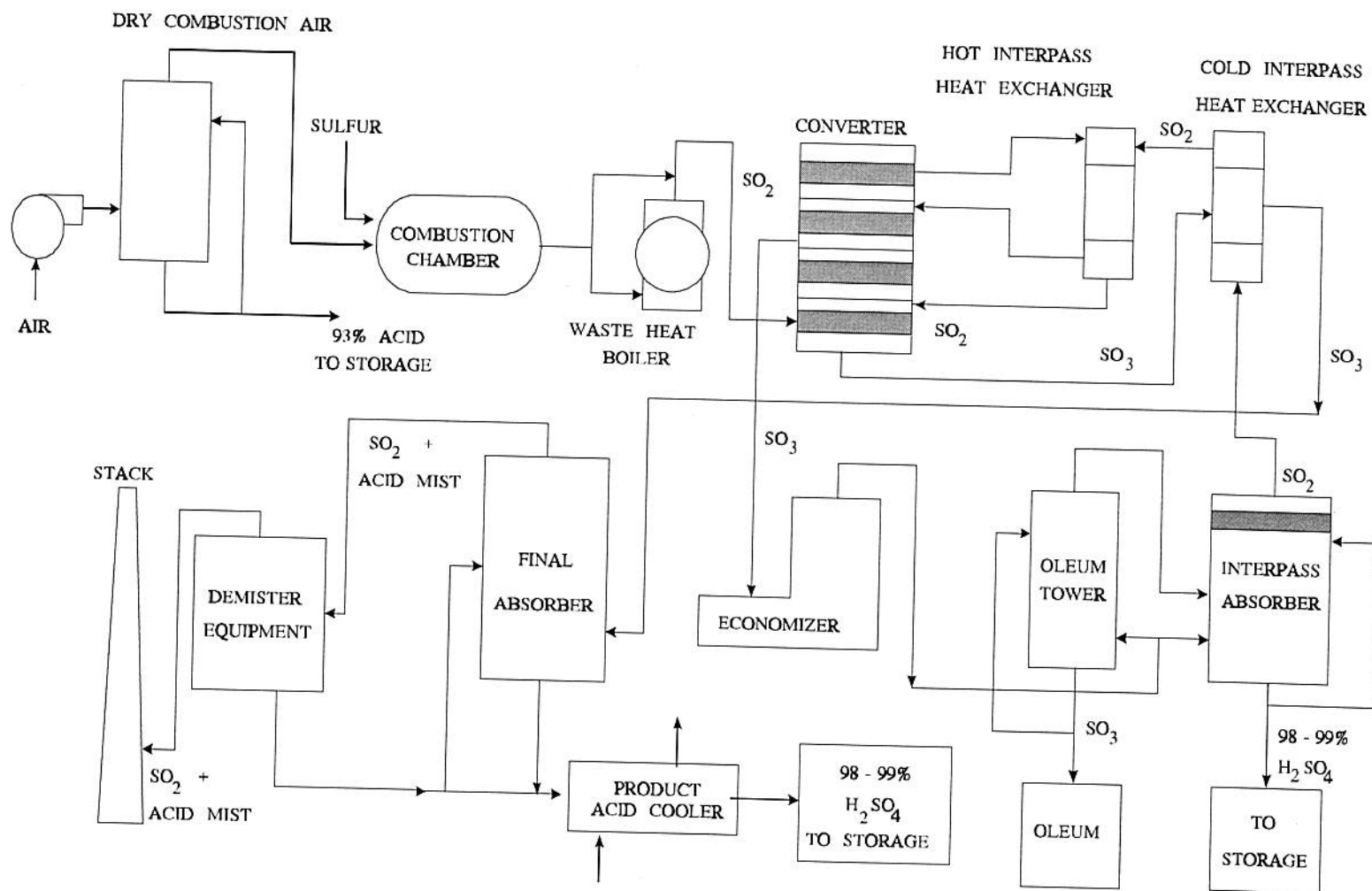


Figure 8.10-1. Typical contact process sulfuric acid plant burning elemental sulfur.

sulfur trioxide is absorbed in the 98 to 99 percent sulfuric acid. The sulfur trioxide combines with the water in the acid and forms more sulfuric acid.

If oleum (a solution of uncombined SO_3 dissolved in H_2SO_4) is produced, SO_3 from the converter is first passed to an oleum tower that is fed with 98 percent acid from the absorption system. The gases from the oleum tower are then pumped to the absorption column where the residual sulfur trioxide is removed.

In the dual absorption process shown in Figure 8.10-1, the SO_3 gas formed in the primary converter stages is sent to an interpass absorber where most of the SO_3 is removed to form H_2SO_4 . The remaining unconverted sulfur dioxide is forwarded to the final stages in the converter to remove much of the remaining SO_2 by oxidation to SO_3 , whence it is sent to the final absorber for removal of the remaining sulfur trioxide. The single absorption process uses only one absorber, as the name implies.

8.10.2.2 Spent Acid And Hydrogen Sulfide Burning Plants -

A schematic diagram of a contact process sulfuric acid plant that burns spent acid is shown in Figure 8.10-2. Two types of plants are used to process this type of sulfuric acid. In one, the sulfur dioxide and other products from the combustion of spent acid and/or hydrogen sulfide with undried atmospheric air are passed through gas cleaning and mist removal equipment. The gas stream next passes through a drying tower. A blower draws the gas from the drying tower and discharges the sulfur dioxide gas to the sulfur trioxide converter, then to the oleum tower and/or absorber.

In a "wet gas plant", the wet gases from the combustion chamber are charged directly to the converter, with no intermediate treatment. The gas from the converter flows to the absorber, through which 93 to 98 percent sulfuric acid is circulated.

8.10.2.3 Sulfide Ores And Smelter Gas Plants -

The configuration of this type of plant is essentially the same as that of a spent acid plant (Figure 8.10-2), with the primary exception that a roaster is used in place of the combustion furnace.

The feed used in these plants is smelter gas, available from such equipment as copper converters, reverberatory furnaces, roasters, and flash smelters. The sulfur dioxide in the gas is contaminated with dust, acid mist, and gaseous impurities. To remove the impurities, the gases must be cooled and passed through purification equipment consisting of cyclone dust collectors, electrostatic dust and mist precipitators, and scrubbing and gas cooling towers. After the gases are cleaned and the excess water vapor is removed, they are scrubbed with 98 percent acid in a drying tower. Beginning with the drying tower stage, these plants are nearly identical to the elemental sulfur plants shown in Figure 8.10-1.

8.10.3 Emissions^{4,6-7}

8.10.3.1 Sulfur Dioxide -

Nearly all sulfur dioxide emissions from sulfuric acid plants are found in the exit stack gases. Extensive testing has shown that the mass of these SO_2 emissions is an inverse function of the sulfur conversion efficiency (SO_2 oxidized to SO_3). This conversion is always incomplete, and is affected by the number of stages in the catalytic converter, the amount of catalyst used, temperature and pressure, and the concentrations of the reactants (sulfur dioxide and oxygen). For example, if the inlet SO_2 concentration to the converter were 9 percent by volume (a representative value), and the conversion temperature was 430°C (806°F), the conversion efficiency would be 98 percent. At this conversion, Table 8.10-1 shows that the uncontrolled emission factor for SO_2 would be 13 kilograms

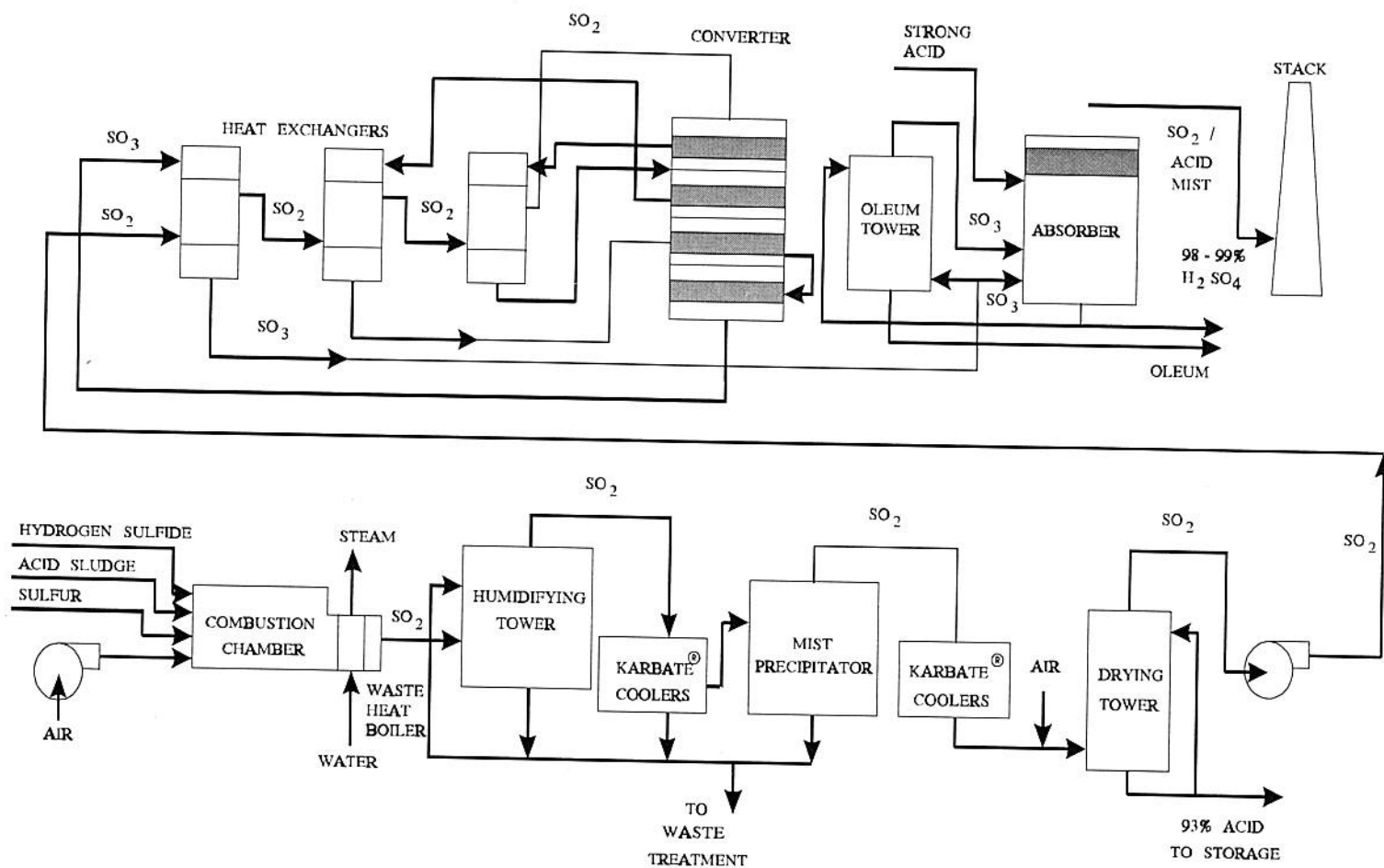


Figure 8.10-2. Basic flow diagram of contact process sulfuric acid plant burning spent acid.

per megagram (kg/Mg) (26 pounds per ton [lb/ton]) of 100 percent sulfuric acid produced. (For purposes of comparison, note that the Agency's new source performance standard [NSPS] for new and modified plants is 2 kg/Mg (4 lb/ton) of 100 percent acid produced, maximum 2 hour average.) As Table 8.10-1 and Figure 8.10-3 indicate, achieving this standard requires a conversion efficiency of 99.7 percent in an uncontrolled plant, or the equivalent SO₂ collection mechanism in a controlled facility.

Dual absorption, as discussed above, has generally been accepted as the best available control technology for meeting NSPS emission limits. There are no byproducts or waste scrubbing materials created, only additional sulfuric acid. Conversion efficiencies of 99.7 percent and higher are achievable, whereas most single absorption plants have SO₂ conversion efficiencies ranging only from 95 to 98 percent. Furthermore, dual absorption permits higher converter inlet sulfur dioxide concentrations than are used in single absorption plants, because the final conversion stages effectively remove any residual sulfur dioxide from the interpass absorber.

In addition to exit gases, small quantities of sulfur oxides are emitted from storage tank vents and tank car and tank truck vents during loading operations, from sulfuric acid concentrators, and through leaks in process equipment. Few data are available on the quantity of emissions from these sources.

Table 8.10-1 (Metric And English Units). SULFUR DIOXIDE EMISSION FACTORS FOR SULFURIC ACID PLANTS^a

EMISSION FACTOR RATING: E

SO ₂ To SO ₃ Conversion Efficiency (%)	SO ₂ Emissions ^b	
	kg/Mg Of Product	lb/ton Of Product
93 (SCC 3-01-023-18)	48.0	96
94 (SCC 3-01-023-16)	41.0	82
95 (SCC 3-01-023-14)	35.0	70
96 (SCC 3-01-023-12)	27.5	55
97 (SCC 3-01-023-10)	20.0	40
98 (SCC 3-01-023-08)	13.0	26
99 (SCC 3-01-023-06)	7.0	14
99.5 (SCC 3-01-023-04)	3.5	7
99.7 NA	2.0	4
100 (SCC 3-01-023-01)	0.0	0.0

^a Reference 3. SCC = Source Classification Code. NA = not applicable.

^b This linear interpolation formula can be used for calculating emission factors for conversion efficiencies between 93 and 100%: emission factor (kg/Mg of Product) = 682 - 6.82 (% conversion efficiency) (emission factor [lb/ton of Product] = 1365 - 13.65 [% conversion efficiency]).

8.10.3.2 Acid Mist -

Nearly all the acid mist emitted from sulfuric acid manufacturing can be traced to the absorber exit gases. Acid mist is created when sulfur trioxide combines with water vapor at a

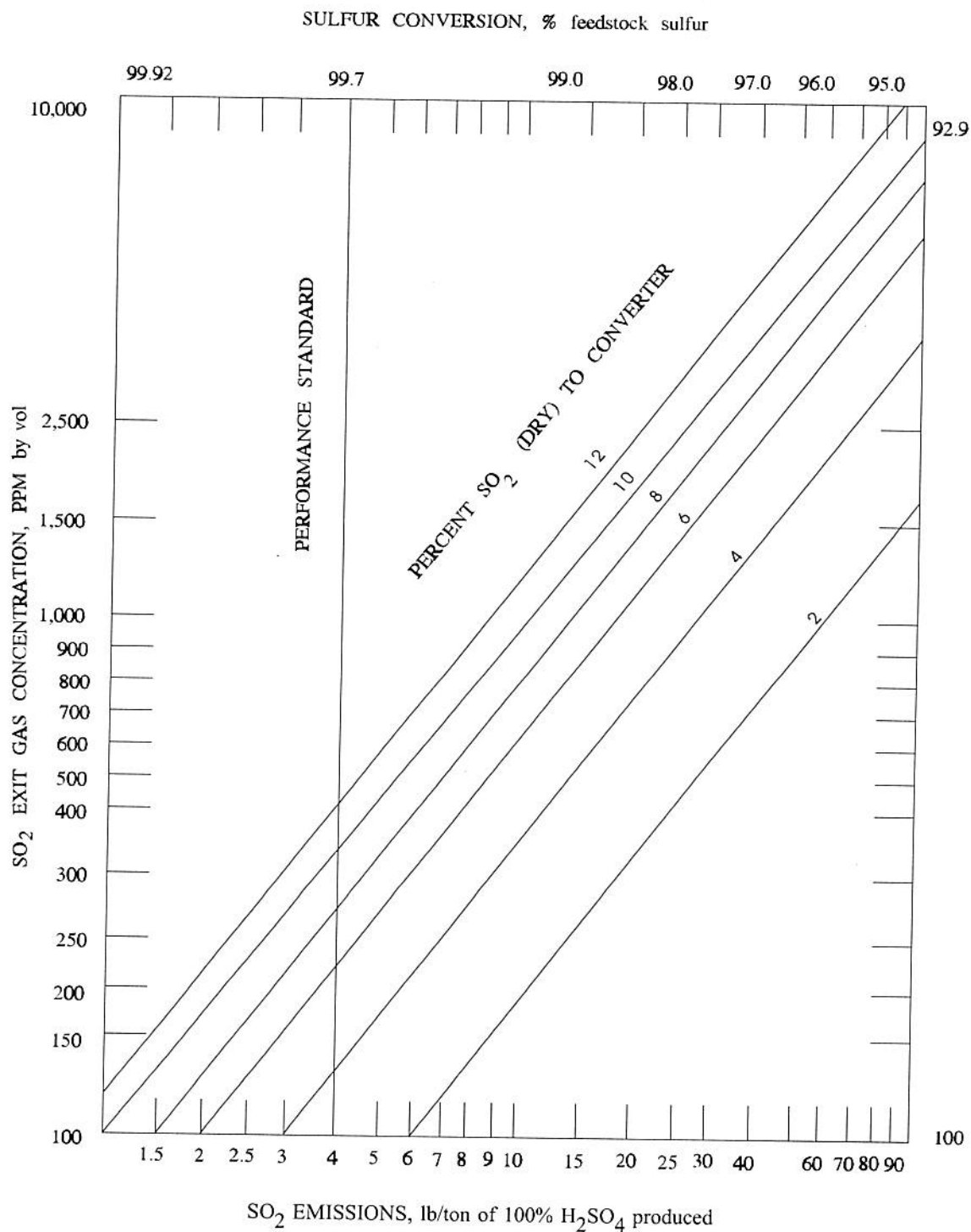


Figure 8.10-3. Sulfuric acid plant feedstock conversion versus volumetric and mass SO₂ emissions at various inlet SO₂ concentrations by volume.

temperature below the dew point of sulfur trioxide. Once formed within the process system, this mist is so stable that only a small quantity can be removed in the absorber.

In general, the quantity and particle size distribution of acid mist are dependent on the type of sulfur feedstock used, the strength of acid produced, and the conditions in the absorber. Because it contains virtually no water vapor, bright elemental sulfur produces little acid mist when burned. However, the hydrocarbon impurities in other feedstocks (i. e., dark sulfur, spent acid, and hydrogen sulfide) oxidize to water vapor during combustion. The water vapor, in turn, combines with sulfur trioxide as the gas cools in the system.

The strength of acid produced, whether oleum or 99 percent sulfuric acid, also affects mist emissions. Oleum plants produce greater quantities of finer, more stable mist. For example, an unpublished report found that uncontrolled mist emissions from oleum plants burning spent acid range from 0.5 to 5.0 kg/Mg (1.0 to 10.0 lb/ton), while those from 98 percent acid plants burning elemental sulfur range from 0.2 to 2.0 kg/Mg (0.4 to 4.0 lb/ton).⁴ Furthermore, 85 to 95 weight percent of the mist particles from oleum plants are less than 2 micrometers (μm) in diameter, compared with only 30 weight percent that are less than 2 μm in diameter from 98 percent acid plants.

The operating temperature of the absorption column directly affects sulfur trioxide absorption and, accordingly, the quality of acid mist formed after exit gases leave the stack. The optimum absorber operating temperature depends on the strength of the acid produced, throughput rates, inlet sulfur trioxide concentrations, and other variables peculiar to each individual plant. Finally, it should be emphasized that the percentage conversion of sulfur trioxide has no direct effect on acid mist emissions.

Table 8.10-2 presents uncontrolled acid mist emission factors for various sulfuric acid plants. Table 8.10-3 shows emission factors for plants that use fiber mist eliminator control devices. The 3 most commonly used fiber mist eliminators are the vertical tube, vertical panel, and horizontal dual pad types. They differ from one another in the arrangement of the fiber elements, which are composed of either chemically resistant glass or fluorocarbon, and in the means employed to collect the trapped liquid. Data are available only with percent oleum ranges for 2 raw material categories.

8.10.3.3 Carbon Dioxide -

The 9 source tests mentioned above were also used to determine the amount of carbon dioxide (CO_2), a global warming gas, emitted by sulfuric acid production facilities. Based on the tests, a CO_2 emission factor of 4.05 kg emitted per Mg produced (8.10 lb/ton) was developed, with an emission factor rating of C.

Table 8.10-2 (Metric And English Units). UNCONTROLLED ACID MIST EMISSION FACTORS FOR SULFURIC ACID PLANTS^a

EMISSION FACTOR RATING: E

Raw Material	Oleum Produced, % Total Output	Emissions ^b	
		kg/Mg Of Product	lb/ton Of Product
Recovered sulfur (SCC 3-01-023-22)	0 - 43	0.174 - 0.4	0.348 - 0.8
Bright virgin sulfur (SCC 3-01-023-22)	0	0.85	1.7
Dark virgin sulfur (SCC 3-01-023-22)	0 - 100	0.16 - 3.14	0.32 - 6.28
Spent acid (SCC 3-01-023-22)	0 - 77	1.1 - 1.2	2.2 - 2.4

^a Reference 3. SCC = Source Classification Code.

^b Emissions are proportional to the percentage of oleum in the total product. Use low end of ranges for low oleum percentage and high end of ranges for high oleum percentage.

Table 8.10-3 (Metric And English Units). CONTROLLED ACID MIST EMISSION FACTORS FOR SULFURIC ACID PLANTS

EMISSION FACTOR RATING: E (except as noted)

Raw Material	Oleum Produced, % Total Output	Emissions	
		kg/Mg Of Product	lb/ton Of Product
Elemental sulfur ^a (SCC 3-01-023-22)	—	0.064	0.128
Dark virgin sulfur ^b (SCC 3-01-023-22)	0 - 13	0.26 - 1.8	0.52 - 3.6
Spent acid (SCC 3-01-023-22)	0 - 56	0.014 - 0.20	0.28 - 0.40

^a References 8-13,15-17. EMISSION FACTOR RATING: C. SCC = Source Classification Code.

^b Reference 3.

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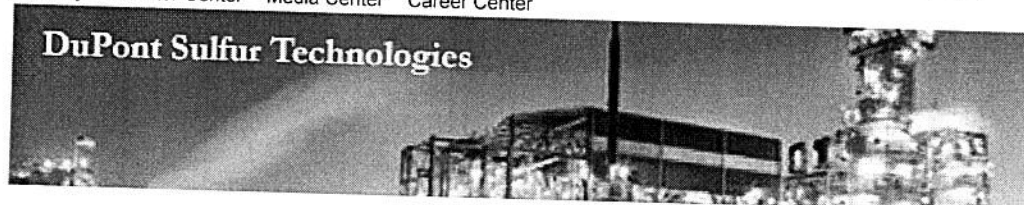
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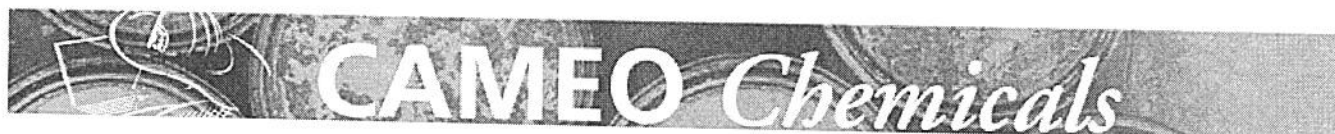
Sulfur Trioxide

Sulfur trioxide (SO₃) is a clear, colorless, oily liquid, but it may contain a slight haze and appear off-white to light brown. As normally handled, SO₃ and oleums have a high vapor pressure; the SO₃ fumes react with the moisture in the air to produce dense, white clouds of sulfuric acid mist.

DuPont offers two grades of SO₃: stabilized and unstabilized. The stabilized grade contains a small quantity of a stabilizer to retard the formation of the undesirable beta and alpha (higher-melting) forms.

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SULFUR TRIOXIDE

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Chemical Identifiers

[What is this information?](#)

CAS Number	UN/NA Number	DOT Hazard Label	CHRIS Code
7446-11-9	1829	CORROSIVE POISON INHALATION HAZARD	none

NFPA 704: data unavailable

General Description

Sulfur trioxide, is a colorless to white crystalline solid which will fume in air. Often shipped with inhibitor to prevent polymerization. It reacts violently with water to form sulfuric acid with the release of heat. It is corrosive to metals and tissue. It causes eye and skin burns. Ingestion causes severe burns of mouth esophagus and stomach. The vapor is very toxic by inhalation. It is a fire risk when in contact with organic materials such as wood, cotton, fiberboard, etc.

Hazards

[What is this information?](#)

Reactivity Alerts

- Strong Oxidizing Agent
- Water-Reactive
- Air-Reactive

Air & Water Reactions

Combines with water with explosive force, forming sulfuric acid due to its acidity Sulfur trioxide chars most organic substances. On exposure to air it absorbs moisture rapidly, emitting dense white fumes [Merck 11th ed. 1989].

Fire Hazard

Fire risk in contact with organic materials. An explosive increase in vapor pressure occurs when the alpha form melts. Combines with water with explosive violence, forming sulfuric acid. May ignite other combustible materials (wood, paper, oil, etc.). Flammable poisonous gases may accumulate in tanks and hopper cars. Runoff to sewer may create fire or explosion hazard. Forms sulfuric acid on contact with water. Avoid water and organic materials. On exposure to air, it absorbs moisture and emits dense white fumes. (EPA, 1998)

Health Hazard

This material is highly toxic. It is an irritant and corrosive to mucous membranes. Poisonous if inhaled or swallowed. Contact causes severe burns to skin and eyes. (EPA, 1998)

Reactivity Profile

The reaction of SULFUR TRIOXIDE and oxygen difluoride is very vigorous and explosions occur if the reaction is carried out in the absence of a solvent [J. Chem. Eng. Data 13(4):529-531. 1968]. The reaction of sulfur trioxide in excess with tetrafluoroethylene causes explosive

decomposition to carbonyl fluoride and sulfur dioxide [Chem. Eng. News 49(22):3. 1971]. The reaction of anhydrous perchloric acid with sulfur trioxide is violent and accompanied by the evolution of considerable heat (Pascal 16:300 1931-34). Liquid sulfur trioxide reacts violently with nitryl chloride, even at 75° C. The reaction of sulfur trioxide and lead oxide causes white luminescence [Mellor 7:654 1946-47]. The combination of iodine, pyridine, sulfur trioxide, and formamide developed a gas over pressurization after several months. This is due to the slow formation of sulfuric acid, from external water or dehydration of the formamide to hydrogen cyanide.

Belongs to the Following Reactive Group(s)

- Acids, Inorganic Oxidizing

Response Recommendations

What is this information? ►

Firefighting

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Ventilate closed spaces before entering them. Wear positive pressure breathing apparatus and special protective clothing.

Do not get water inside container. Small fires: dry chemical or carbon dioxide. Large fires: flood fire area with water from a distance. Do not get solid stream of water on spilled material. Move container from fire area if you can do so without risk. Spray cooling water on containers that are exposed to flames until well after fire is out. (EPA, 1998)

Non-Fire Response

Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Use water spray to knock-down vapors. Neutralize spilled material with crushed limestone, soda ash, or lime. Land spill: Dig a pit, pond, lagoon, holding area to contain liquid or solid material. Cover solids with a plastic sheet to prevent dissolving in rain or fire fighting water. Dike surface flow using soil, sand bags, foamed polyurethane, or foamed concrete. Water spill: Use natural barriers or oil spill control booms to limit spill travel. Use natural deep water pockets, excavated lagoons, or sand bag barriers to trap material at bottom. Remove trapped material with suction hoses. (AAR, 2003)

Protective Clothing

For emergency situations, wear a positive pressure, pressure-demand, full facepiece self-contained breathing apparatus (SCBA) or pressure-demand supplied air respirator with escape SCBA and a fully-encapsulating, chemical resistant suit. (EPA, 1998)

____ Dupont Average Standardized Breakthrough Times ____
(for SULFUR TRIOXIDE)

Tychem® BR
90 min. (concentration: 95+%)
Tychem® LV
90 min. (concentration: 95+%)
Tychem® Reflector®
90 min. (concentration: 95+%)
Tychem® Responder®
90 min. (concentration: 99%)
Tychem® Responder® CSM
90 min. (concentration: 99%)
Tychem® TK
90 min. (concentration: 95+%) (DuPont, 2008)

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First Aid

Warning: Sulfur trioxide is extremely corrosive. Caution is advised.

Signs and Symptoms of Sulfur Trioxide Exposure: Signs and symptoms of acute ingestion of sulfur trioxide may be severe and include salivation, intense thirst, difficulty in swallowing, chills, pain, and shock. Oral, esophageal, and stomach burns are common. Vomitus generally

has a coffee-ground appearance. The potential for circulatory collapse is high following ingestion of sulfur trioxide. Acute inhalation exposure of sulfur trioxide may result in sneezing, hoarseness, coughing, choking, laryngitis, and respiratory tract irritation. Bleeding of nose and gums, ulceration of the nasal and oral mucosa, bronchitis, pneumonia, dyspnea (shortness of breath), chest pain, and pulmonary edema and respiratory failure may also occur. Eye exposure to sulfur trioxide may result in irritation, pain, swelling, corneal erosion, and blindness. Dermal exposure may result in dermatitis (red, inflamed skin), severe burns, and pain.

Emergency Life-Support Procedures: Acute exposure to sulfur trioxide may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination.

Inhalation Exposure:

1. Move victims to fresh air. Emergency personnel should avoid self-exposure to sulfur trioxide.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. Transport to a health care facility.

Dermal/Eye Exposure:

1. Remove victims from exposure. Emergency personnel should avoid self-exposure to sulfur trioxide.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Remove and isolate contaminated clothing as soon as possible.
4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes.
5. Wash exposed skin areas thoroughly with soap and water.
6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
7. Transport to a health care facility.

Ingestion Exposure:

1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
2. DO NOT induce vomiting or attempt to neutralize!
3. Rinse mouth with large amounts of water. Inform victims not to swallow this water.
4. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
5. Activated charcoal is of no value.
6. Give the victims water or milk: children up to 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old, 200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). Water or milk should be given only if victims are conscious and alert.
7. Transport to a health care facility. (EPA, 1998)

Physical Properties

What is this information? ►

Molecular Formula: SO₃

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 144° F Alpha form 90.5° F Beta form 62.2° F Gamma form (EPA, 1998)

Vapor Pressure: 73 mm Hg at 77° F Alpha form 344 mm Hg at 77° F Beta form 433 mm Hg at 77° F Gamma form (EPA, 1998)

Vapor Density (Relative to Air): 2.76 (EPA, 1998)

Specific Gravity: 1.92 at 68.0 ° F Gamma form (liquid) (EPA, 1998)

Boiling Point: 113 ° F at 760 mm Hg all forms (EPA, 1998)

Molecular Weight: 80.06 (EPA, 1998)

Water Solubility: data unavailable

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Sulfur trioxide (7446-11-9)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	0.2 mg/m3	8.7 mg/m3	270 mg/m3
30 minutes	0.2 mg/m3	8.7 mg/m3	200 mg/m3
60 minutes	0.2 mg/m3	8.7 mg/m3	160 mg/m3
4 hours	0.2 mg/m3	8.7 mg/m3	110 mg/m3
8 hours	0.2 mg/m3	8.7 mg/m3	93 mg/m3

(NAC/NRC, 2011)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Sulfuric Acid (Oleum [8014-95-7], Sulfur Trioxide [7446-11-9], and Sulfuric Acid [7664-93-9])	2 mg/m3 ☼	10 mg/m3	120 mg/m3

☼ indicates that odor should be detectable near ERPG-1.

(AIHA, 2011)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Sulfur trioxide (7446-11-9)	0.2 mg/m3	8.7 mg/m3	160 mg/m3

(SCAPA, 2012)

Regulatory Information

What is this information? ►

Regulatory Names: SULFUR TRIOXIDE

CAA RMP: Regulated chemical with a Threshold Quantity of 10000 pounds.

CERCLA: Not a regulated chemical.

EHS (EPCRA 302): Regulated chemical with a Reportable Quantity of 100 pounds and a Threshold Planning Quantity of 100 pounds.

TRI (EPCRA 313): Not a regulated chemical.

RCRA Chemical Code: none

Alternate Chemical Names

What is this information? ►

- SULFAN
- SULFUR OXIDE (SO3)

- SULFUR TRIOXIDE, INHIBITED
- SULFUR TRIOXIDE, STABILIZED
- SULFUR TRIOXIDE, UNINHIBITED
- SULFUR TRIOXIDE, [INHIBITED]
- SULFURIC ANHYDRIDE
- SULFURIC OXIDE
- SULPHUR TRIOXIDE
- SULPHUR TRIOXIDE, INHIBITED
- SULPHUR TRIOXIDE, STABILIZED
- SULPHUR TRIOXIDE, UNINHIBITED
- TRIOXYDE DE SOUFRE (DOT FRENCH)
- TRIOXYDE DE SOUFRE, NON STABILISÉ (DOT FRENCH)
- TRIOXYDE DE SOUFRE, STABILISÉ (DOT FRENCH)
- TRIÓXIDO DE AZUFRE (DOT SPANISH)
- TRIÓXIDO DE AZUFRE, ESTABILIZADO (DOT SPANISH)
- TRIÓXIDO DE AZUFRE, INHIBIDO (DOT SPANISH)
- TRIÓXIDO DE AZUFRE, NO INHIBIDO (DOT SPANISH)

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